

A few Notes on South African Chamæleons, &c. By G. B. LONGSTAFF, D.M., M.A., of New College, Oxford, and EDWARD B. POULTON, D.Sc., M.A., F.R.S., Hope Professor of Zoology in the University of Oxford, and Fellow of Jesus College, Oxford.

[Read 7th March, 1907.]

THE following observations were made during the visit of the British Association to South Africa in 1905. The conditions were not favourable to continuous investigation: nevertheless, I believe that some of these scattered notes are not without interest, especially those referring to the automatic adjustable countergrading of shadow on the two sides of the chamæleon. It is probable that the independent control of the colours of the two sides of the body has been often observed before, but, so far as I am aware, this is the first attempt to explain the significance of the power. The illuminating effect of a great hypothesis like that of Mr. Abbott H. Thayer's in the realm of protective coloration is well seen in the fact that Dr. Longstaff, Professor C. V. Boys, and the present writer independently grasped the meaning of the colour-change the moment it took place before their eyes. I do not know whether my two friends have studied Mr. Thayer's writings or examined his beautiful models at London, Oxford, or Cambridge \*, but I have no doubt that it is the result of his work that interpretation was "in the air."

I have to thank Mr. G. A. Boulenger, F.R.S., for kindly naming the specimens upon which the following observations were made.—E. B. P.

1. Note on CHAMÆLEON DILEPIS, *Leach*, ♀. By Dr. G. B. LONGSTAFF.

The chamæleon was taken near the Waterworks, Bulawayo, Sept. 9th, 1905 (about 3–4 feet from the ground), on a shrub of *Dombeya* (? *rotundifolia*), the white flowers of which were attracting a number of insects of various orders. I was startled on detecting the animal, which at first escaped my notice.

*Description*.—Pale yellowish grey, legs and tail darker; streaked and blotched with greenish grey. Throat with six cadmium-yellow stripes. A yellow spot behind the shoulder, another over the ribs, and a yellow lateral line.

It gives vent to a gurgling hiss when disturbed, and once bit me, but not hard.

Kept alive and observed at Victoria Falls, Sept. 16th, 1905. Placed on a plant of young *Acacia*, the animal soon lost all its darker bands and became almost uniform grey-green, with the above yellow markings. In the

\* [I was familiar with Mr. Thayer's models.—G. B. L., July 17, 1907.]

sun it became strongly mottled, with some tendency to be paler on the shady side, but this was not very marked. Excrement consisted of elytra and other insect-fragments.

When chloroformed, it became a uniform pale yellowish, a little paler than my khaki coat : that is to say, assumed its *palest* coloration.

## 2. *By* Professor E. B. POULTON.

A fine specimen of *Chamæleon dilepis* was found by Mr. A. D. Hall at a station on the railway, Sept. 11th, the day before reaching the Victoria Falls. The chamæleon was hiding in the deserted nest of a weaver-bird. Mr. Hall kindly gave the specimen to me. It lived in its nest on the train and on the steamer for two weeks without making any attempt to escape. During all this time the chamæleon remained of a straw-colour, which admirably matched the tint of the nest. When removed from the nest and placed on various surfaces its colours did not change. It refused all food, and was probably passing through a dry-season hibernation. In about a fortnight its colour became greenish, it drank, and on one occasion began to wander. Finally, on Sept. 29th, it took the first meal, devouring spiders and insects with the utmost avidity. Its chief food throughout the long voyage was the special cockroach of the 'Durham Castle,' *Phyllodromia germanica*, of which it must have eaten hundreds. Having once begun, the chamæleon maintained its appetite, until in the late autumn it was deposited in the Zoological Gardens, where it unfortunately died in the winter. The existence in the dry season of a fasting period, during which the colours are steadfast, was unknown to me and, if hereafter confirmed, would appear to be a fact of considerable interest in the life of this species of chamæleon.

## 3. *Note on* CHAMÆLEON PUMILUS, *Daudin*, ♀. *By* Dr. G. B. LONGSTAFF.

Taken on a shrub, about four feet from ground, in the Botanical Gardens, Cape Town, 9th August, 1905.

*Description*.—Apple-green ; at the back of the eye two patches of greyish-pink placed vertically ; a lateral stripe of the same colour extending from shoulder to pelvis, widest in middle, where are two dark grey spots. Several orange tubercles on the back. Belly striped with greenish white ; underside of head striped blue-green and pink. The ground varies to dusky green.

Kept in confinement. Observations on same made at Durban, 16th Aug., 1905. After it had been kept for some time in the dark it became of the brightest apple-green. On exposure to light it darkened. Placed on a dark "uniform-case" near the window in bright light it darkened *along the dorsal area*.

Taken out into the garden and placed alternately on a black pair of trousers and on a white towel. It darkened in both cases, but there was no

noticeable difference. Then put on a twig of a shrub with bright green leaves it became paler. The side *away from the sun* was of the brightest apple-green, the outer side (towards the sun) was *darker along the back*. The bright green harmonized wonderfully with the young leaves, the creature appeared flat, and was scarcely distinguishable. The neck and belly did not appear to change colour.

It was then killed, being rapidly overcome by chloroform, then becoming more dusky than seen previously: that is to say, it assumed its *darkest* coloration. If the result in the first case was paralytic in its nature, it would appear in the second case to have been stimulant; or *vice versâ*.

#### 4. *By* Professor E. B. POULTON.

Three specimens of *Chamæleon pumilus*, two large and one small, were kindly given to me by a keen naturalist friend, Miss Molly Jenkins, the daughter of my kind host, Rev. Canon Jenkins, D.D., Principal of the Diocesan College, Rondebosch. The small individual soon died, and one of the others did not live long. The third was a very healthy specimen, and upon it the following notes were made. The behaviour of *C. pumilus* afforded the strongest contrast to that of *C. dilepis*, for, with few exceptions, it accepted food whenever offered. The exceptions are of considerable interest. On one occasion it was offered the spinous reddish caterpillar of an *Acræa*, which it made heroic efforts to eat, but finally rejected. At another time a hard rough brown weevil (almost certainly *Spartecerus rudis*, Fähr.) was seized and instantly abandoned. When it is remembered that both *Acræas* and weevils are mimicked by species belonging to other and very different groups, the behaviour of the chamæleon is seen to be highly significant. It would be deeply interesting to experiment further and attempt to ascertain whether the weevil was rejected because of the instant recognition of its excessive hardness\*, or on account of some other special protection. *C. pumilus* devoured the cockroaches on the ship, but was not nearly so fond of them as its larger relative. Flies appeared to be its favourite food. This specimen was also deposited in the Zoological Gardens, where it lived for some weeks longer than *dilepis*. It died about New Year's Eve.

Good fortune gave me as companions in the same compartment of the train two physicist friends, Captain Creak, F.R.S., and Professor C. V. Boys, F.R.S. One day, when *C. pumilus* was resting on the compartment table, with the long axis of its body parallel to the window, Professor Boys, who was certainly intended for a naturalist, pointed out that the strongly illuminated side, next to the window, was dark green, while the side in deep shadow, away from the light, was of the brightest tint. The same relationship between the illuminated and the unilluminated side was seen on many occasions.

\* See Trans. Ent. Soc. Lond. 1902, pp. 322-25.



This appears to be a most interesting adaptation—a dynamic manifestation of the principle discovered in its static form by Mr. Abbott H. Thayer. Mr. Thayer first suggested that the relative shades of the dark back, lighter sides, and white under sides of animals were such as just to counterbalance the diminution of natural illumination from an open sky as we pass from the back down the sides to the under surface; that the object of this countergrading was to neutralise the shadow which would otherwise render the animal conspicuous. *C. pumilus*, as I have said, manifests the same principle in a dynamic form. The side that happens to be turned away from the light is brightened sufficiently to neutralise the shadow; the high illumination of the other side is toned down by darkening, the effect being that all appearance of solidity is dissipated. This result must be of great importance to so large and so defenceless an animal as the chamæleon. But for this adjustable countergrading, the varying degrees of illumination on the side and dorsal slope turned towards the light, combined with the strong shadow on the other side, would cause it to stand out among the leaves as an object of conspicuous solidity and thickness.

5. *Note on the Vitality of the Tail of a South African Gecko, PACHYDACTYLUS MACULATUS, A. Smith. By Dr. G. B. LONGSTAFF.*

The Gecko on which the following observations were made was found under a stone on Hlangwana Hill, Colenso, 24th August, 1905.

Sluggish; eyes large. Body dull pale brown, with a conspicuous row of dark brown spots on either side of the back, outlined with black and outside that with pale ash; belly flesh-colour.

When chloroformed, the short stumpy tail was cast off (causing slight hæmorrhage), and took much longer to die than the body, wriggling with a spiral movement.

[The vitality and activity of the tails of lizards after they have been cast off are, I believe, an adaptation for the purpose of aiding in the escape from a pursuing enemy. The tail becomes for the moment a more lively and interesting object than the lizard itself, and is likely to distract the attention of an enemy. It is probable that the phenomena are not to be explained merely by the temporary maintenance of vitality in the tissues of an amputated part, but that the special activity manifested is due to accumulation through natural selection. See Proc. Bost. Soc. Nat. Hist. vol. xxvi. 1895, p. 388.—E. B. P.]

[The persistence of movements in the tail under the special conditions described above was doubtless mainly due, as suggested in the discussion by the President, Professor Herdman, to the fact that the amputated part had lost its connection with the respiratory and circulatory organs, by means of which the chloroform is conveyed to the tissues.—E. B. P., July 12, 1907.]

[Professor Herdman's explanation is doubtless the correct one, and tallies with the fact that active insects, such as Humble-bees, succumb much more rapidly to volatile poisons than more sluggish Beetles of the same size. At the time, however, I connected the greater activity of the tail with the absence of a brain.—G. B. L., July 17, 1907.]